

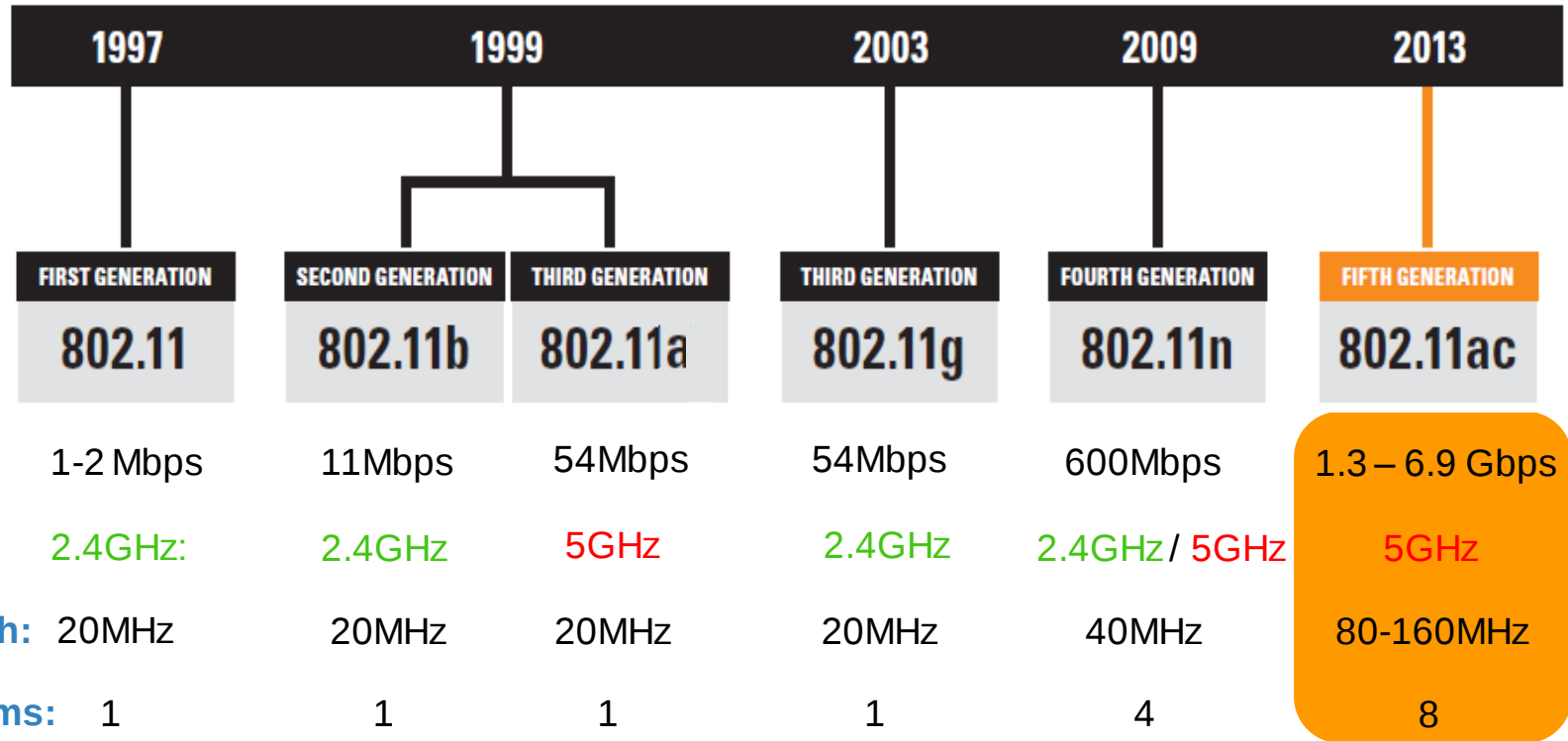
JULY 2013

WHAT YOU NEED TO KNOW ABOUT 802.11AC

DEMYSTIFYING THE BUSINESS AND TECHNICAL
IMPLICATIONS OF THE NEXT GENERATION OF
WLAN TECHNOLOGY



BRIEF HISTORY OF WIFI



IEEE 802.11AC BASICS



Title: Enhancements for Very High Throughput for operation in bands below 6GHz

Scope: Modifications to both the 802.11 physical layers (PHY) and 802.11 Medium Access Control Layer (MAC)

- **At least 1 Gbps** Multi-station (STA) throughput and a maximum single link throughput of at least 500 Mbps
- 6 GHz below carrier frequency operation **excluding 2.4GHz**
- **Backwards compatible** and coexistence with legacy IEEE802.11 devices in the 5 GHz unlicensed band.

Project Purpose: Significantly higher throughput for existing WLAN application areas and to enable new market segments for

TECHNICAL FEATURES

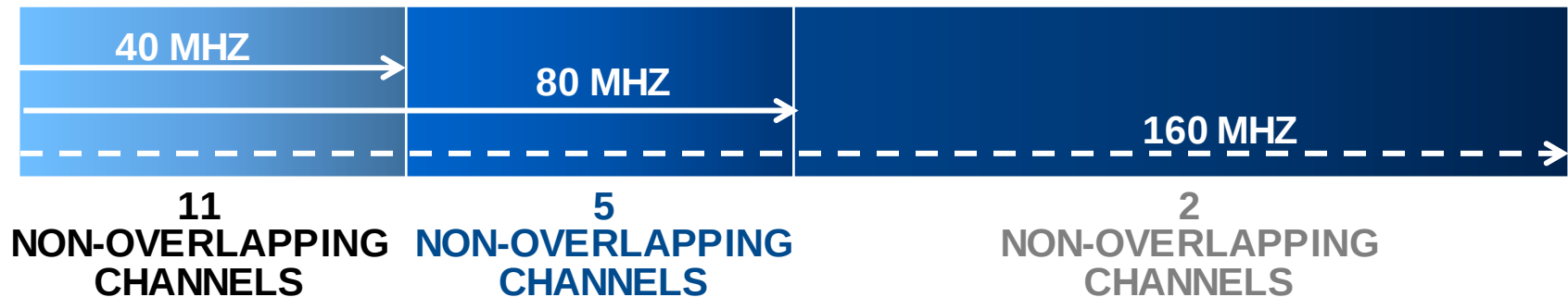


- 1. Wider Channels:** 80 MHz and 160 MHz channel bandwidth
- 2. New Modulation and Coding:** 256-QAM, code rates of $3/4$ and $5/6$, added as optional modes.
- 3. More spatial streams:** Up to 8 compared to 4 in 802.11n
- 4. Multi-user MIMO:** Multiple devices, each with multiple antennas, transmits or receives independent data streams simultaneously.

CHANNEL BANDWIDTH



802.11ac provides Very High Throughput by using much wider spectrum @ 5 GHz



80 MHz mandatory, 160 MHz optional

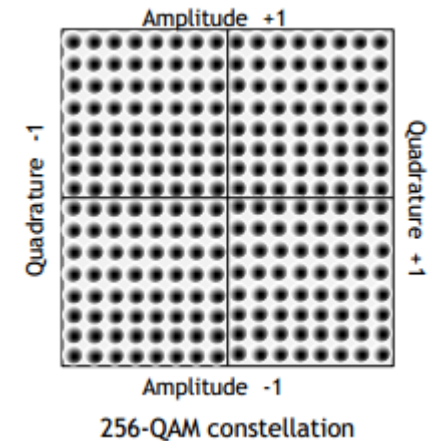
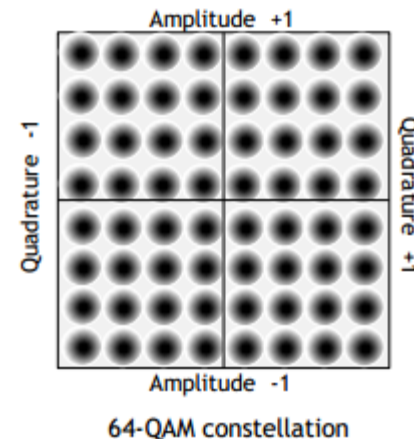
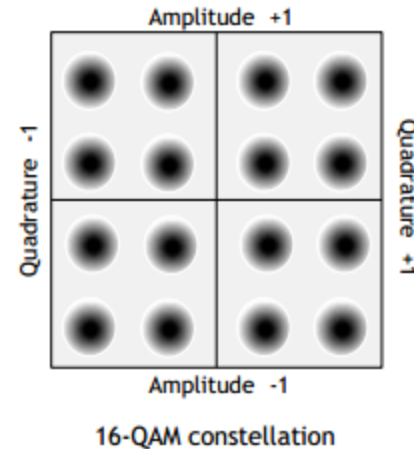
Dynamic bandwidth allocation ensures multiple AP's have access to the same wide channels.

MODULATION AND CODING



Adds 256-QAM options with code rates of 3/4 and 5/6

MCS Index	Modulation	Code Rate
0	BPSK	$\frac{1}{2}$
1	QPSK	$\frac{1}{2}$
2	QPSK	$\frac{3}{4}$
3	16-QAM	$\frac{1}{2}$
4	16-QAM	$\frac{3}{4}$
5	64-QAM	$\frac{2}{3}$
6	64-QAM	$\frac{3}{4}$
7	64-QAM	$\frac{5}{6}$
8	256-QAM	$\frac{3}{4}$
9	256-QAM	$\frac{5}{6}$

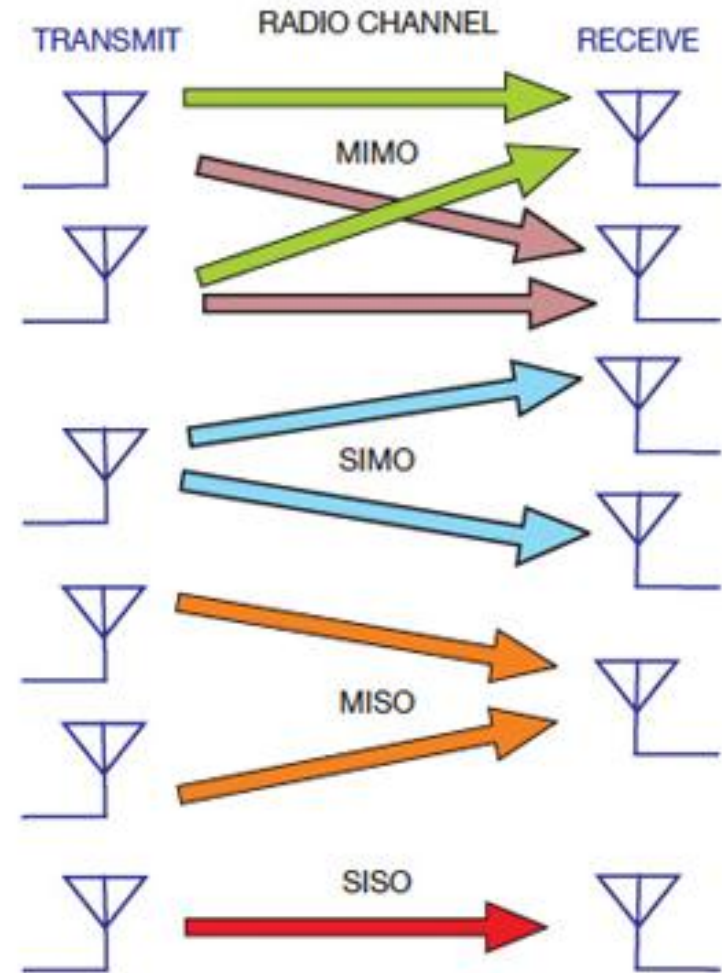


SPATIAL STREAMS



Up to 8 spatial streams in both single-user (SU) and multi-user (MU) (maximum was 4 in 802.11n)

Adding spatial streams increases throughput proportionately assuming multipath conditions are favourable.



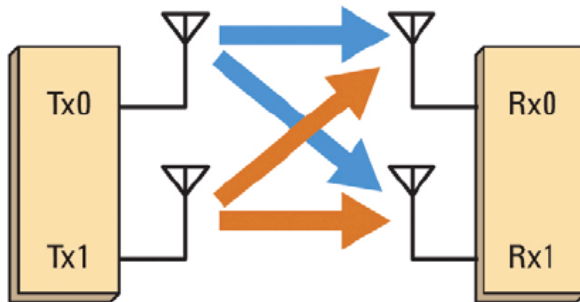
MULTI-USER MIMO



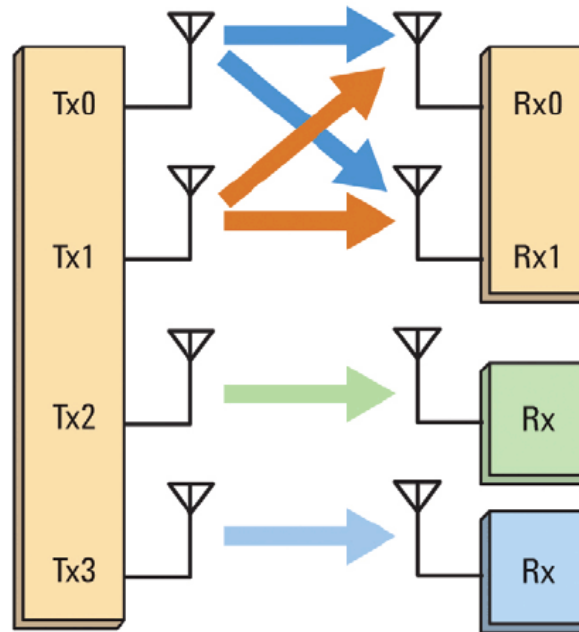
802.11ac introduces MU-MIMO to transmit or receive independent data streams simultaneously.

Requires beamforming to minimise interference at other clients.

MIMO (2x2)



MULTI-USER MIMO
4 streams, 3 users



802.11AC MAX LINK RATES



Channel Bandwidth	Transmit – Receive Antennas	Modulation and Coding	Typical Client	Throughput (individual rate)	Throughput (aggregate rate)
80 MHz	1x1	256-QAM 5/6, SGI	Smartphone	433 Mbps	433 Mbps
80 MHz	2x2	256-QAM 5/6, SGI	Tablet, PC	867 Mbps	867 Mbps
160 MHz	1x1	256-QAM 5/6, SGI	Smartphone	867 Mbps	867 Mbps
160 MHz	2x2	256-QAM 5/6, SGI	Tablet, PC	1.73 Gbps	1.73 Gbps
160 MHz	4x Tx AP, 4 clients of 1x Rx	256-QAM 5/6, SGI	Multiple Smart phones	867 Mbps	3.47 Gbps
160 MHz	8x Tx AP, 4 clients with total of 8x x	256-QAM 5/6, SGI	Digital TV, set-top, tablet, PC, smart phone	867 Mbps to two 1x clients 1.73 Gbps to one 2x client 3.47 Gbps to one 4x client	6.93 Gbps
160 MHz	8x Tx AP, 4 clients of 2x Rx	256-QAM 5/6, SGI	Multiple set-top boxes, PCs	1.73 Gbps to each client	6.93 Gbps

HOW DOES THIS AFFECT YOU?



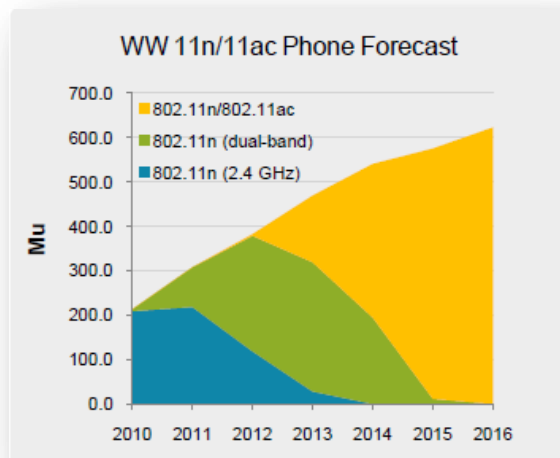
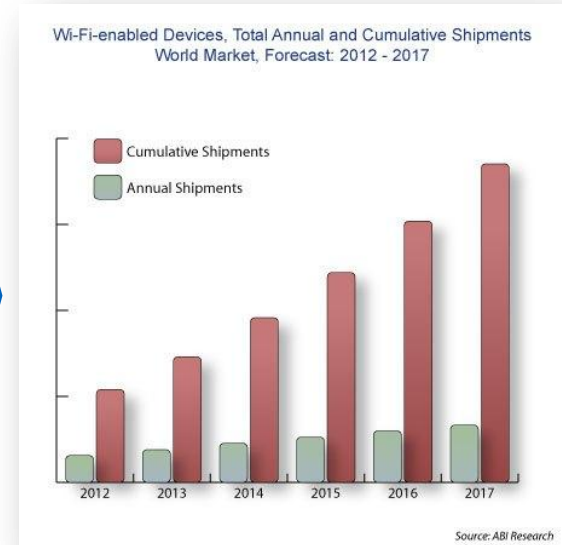
MARKET TRENDS

Driving the need for capacity

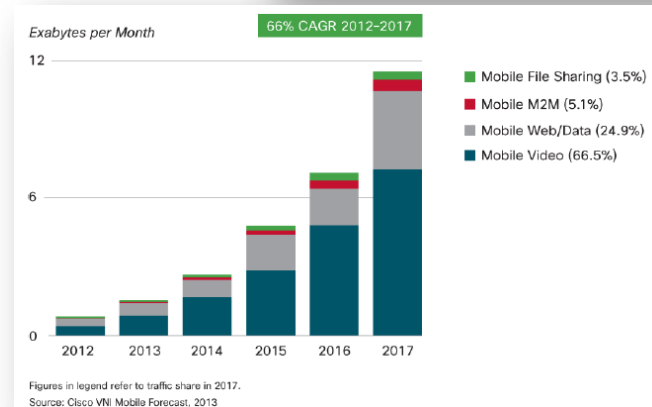


Source: ABI Research 2011

• 1.5 Billion devices shipped in 2012
• Over 9 Billion shipped since 2009



By 2015, 70% of handset shipments will use 802.11ac



Video will rise to 66.5 per cent of all mobile traffic by 2017, growing at a CAGR of 75%, faster than any other mobile application category

EQUIPMENT SELECTION



Wi-Fi Alliance Interoperability Certification



Software functionality, upgradability and quality

Captive Portal (Hotspot 2.0) capabilities

Wired switching and routing (1 Gbe / 10 Gbe / 40 Gbe)

NETWORK ARCHITECTURE



	Autonomous AP's	Controller Based AP's	Distributed AP's
Location of data plane	Distributed, enabling high network performance	Centralised, limiting performance due to controller bottleneck.	Distributed enabling high network performance.
Location of management plane	Usually distributed, imposing high staff management costs	Centralised, lowering operational costs.	Usually centralised enabling lower operational costs.
Location of control plane	Non existent control plane limits security and RF management	Centralised with good capabilities for RF and user management.	Usually centralised however depends on vendor implementation.

DEPLOYMENT CONSIDERATIONS

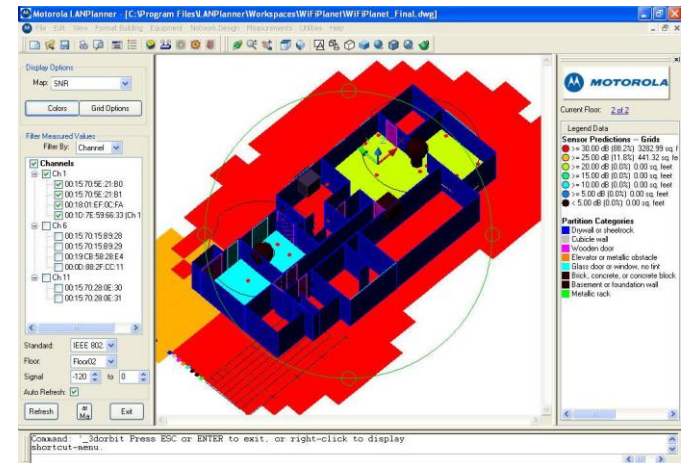


Client count, density and mix

Coverage and Capacity Planning

Applications (Video / Voice)

Security Planning



Commercial Availability

- i) Enterprise AP's available Q2/Q3 2013**
- ii) Standard Ratification Q4 2013**
- ii) MU-MIMO (Phase 2 802.11ac) H2 2014**



THANK YOU